An international organization of artists, scientists, authors, curators, educators, and art enthusiasts who explore the intersection of the arts and sciences. Science and technology are driving forces in contemporary culture. Ylem members strive to bring the humanizing and unifying forces of art to this arena. Ylem members work in new art media such as Computers, Kinetic Sculpture, Interactive Multimedia, Holograms, Robotics, 3-D Media, Film, and Video.

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Lilith Arising from web project by Sonya Rapoport

Visual Vicissitudes: Digital and Otherwise

Special Double Issue

From the Editors
Sonya Rapoport and Loren Means

VISUAL VICISSITUDES: Digital and Otherwise

VISUAL VICISSITUDES: Digital and Otherwise, the topic selected for this issue of the YLEM newsletter, is a reflection on whether or how the visual element in art practice has been sustained in digitally mediated art forms. Varied vagaries of contemporary visual expression are addressed.

Among the contributors, Ernestine Daubner sets the visional/a-visional stage with Marcel Duchamp's L.H.O.O.Q.: LOOKing Towards Digital Interactive Art and the Dialogical Eye/I. Her insightful interpretations of the Leonardo/Duchamp interface guide us to hypertexual interactions.

Barbara Lee Williams focuses on the vicissitudes of web visuals. Coming from a "primacy of vision" that Ernestine Daubner, in her article, attributes to Leonardo's "Mona Lisa," Barbara Lee Williams laments frequent abandonment of aesthetic form in art works designed for the web. Nevertheless, she refers to web artist Graham Harwood's dependency on visionary aesthetics as "art that makes you 'Look again, think again.'"

Harwood's use of morphing technology for altering portraits technically updates Duchamp's use of the pencil. Daubner observes that Duchamp's act of "penciling in" is the end of the observer/observed model, leading to digital interactive art.

Paul Hertz gives a twist to Visual Vicissitudes when he picks up on the impact of digital technologies on media production. He regrets that many of the art themes resulting from computational research, scientific thought, algorithmic processes and so on, are rarely viewed in public art spaces, remaining barely visible in the art world.

The theme of visualization is included among Hertz's vicissitudes. This mode of art expression is amply described by Jack Ox in her article about her own work, the metaphoric process of music visualization.

Sonya Rapoport, multimedia and web artist, produces cross-cultural interactive artworks referencing science, biblical, and gender topics. She serves on the governing board of directors of Leonardo/ISAST and the community advisory board of the Berkeley Museum, University of California. She writes art reviews for Leonardo publications, published by MIT. Sonya's web site is: www./anminds.com/local/srapoport.html

This special double issue of the Ylem Newsletter has taken a little longer than we expected, because we're in a transition period recovering from Marius Johnston's decision to concentrate on his duties as Ylem's Web Master, and relinquish his position as the Newsletter's Executive Editor. Marius took the Newsletter from its status as a chatty organ of announcements and member news and built it into a magazine, with articles of depth and breath and wide-reaching interest. Basically, he did it all himself. Now the rest of us are learning how to produce the Newsletter as a team; I'm pitching in as editor of the second half of this double issue, and Marcia Weisbrot is handling the layout for the first time. I've guest edited issues of the Newsletter before, and Marcia is an accomplished book artist.

This issue of the Newsletter features articles of a nature that is unusual for Ylem. Sonya Rapoport's guest editorship is providing analysis of web art from the perspective of art scholarship, an approach I'd like to see more of in the Newsletter. And the article by Rudy Rucker in my section of the Newsletter addresses the art and commerce of game development, a computer-based creative endeavor that, to my knowledge hasn't been pursued in this publication before. We're going from the sacred to the profane here, a wide pendulum swing, and possibly a harbinger of things to come.

Rucker is one of my favorite science fiction writers. He is a pioneer of Cyberpunk, and the author of a series of serio-comic novels that includes Software, Wetware, and Freeware. He has written non-fiction on high math and the fourth dimension, and developed games with AutoDesk. He teaches math at San Jose State University.

Torrey Nommesen is an artist, web master, and former gallery owner who studied with Stephen Wilson at San Francisco State University. His work was featured in the Subversive Science Fair in Oakland, CA, and in a solo show, *Poems on the Floorspace* at Atelier 1700 in San Francisco. He attended *Siggraph 2001* as YLEM's correspondent, and there met digital artist Robert Krawczyk. Torrey's web page is http://torrey.nommesen.com.

I ran across JD Jarvis when he responded with a compliment on an article of mine posted on the web site for the Silicon Valley Art Museum. I reciprocated by looking up JD's web site, and then invited JD to write about his work for the Ylem Newsletter. Jarvis makes his living as a TV director and editor, and has worked with video and mixed media since 1975. His work with artists at the National Center for Experiments in Television in San Francisco won an Emmy, and he recently won Grand Prize from the Toray Corporation of Tokyo's "Digital Creative Awards."

Loren Means's website is : http://lmeans.n3.net

Ylem Yearly Membership includes:

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An annual publication in which you are listed along with approximately 250 other artists of new art forms.
Newsletters
The bi-monthly Ylem Newsletter contains articles on numerous topics along with news of members, a
Calendar
of events and art opportunities.
Forums
Ylem presents bi-monthly Forums at San Francisco's Exploratorium, curates art shows, and arranges special site visits.
Ylem Slide Registry
An opportunity to join our Member's slide registry. The registry is presented to curators by the Ylem Exhibits Committee, An initial fee of $15.00 ($5.00 annual renewal) is charged to cover the preparation of professional-level presentations.
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Carnival

YLEM Membership Meeting
Held at 7:15 pm, just before the YLEM Forum (below)

YLEM holds an election for its board every two years. Members, this is your chance to meet the candidates and vote. This election is notable because Trudy Myrrh Reagan, founder and president, is retiring. Plan to attend this important meeting!

YLEM Forum: "Visual Mathematics"
March 20, 7:45 pm
McBean Theater, The Exploratorium
3501 Lyon, San Francisco, CA
The program will include a tour through the
"Mathematica" exhibit designed
by Charles and Ray Eames.

Trans Humanism, Technology and the Spirit of Play
at The Exploratorium until February 16
3601 Lyon St. , San Francisco, CA 94123
Free, open to the public, wheelchair accessible.

All kinds of funny, fascinating and just plain weird art lies at the fringes! Carl Pisaturo's robots, David Cox's eerie films from Australia and William Lind, the chief bureaucrat at the Bureau of Low Technology, will provide a diverting evening.

First, two upper-body robots of Carl Pisaturo have been invited. Slave(o) and Slave(1). They'll dance the struggle between their inner and outer worlds. Carl will give a brief slide show and demonstration of the 2 robots. Pisaturo's finely-crafted robots are primarily "limb oriented" and are remarkable for their smooth, complex motions. These robots employ innovative cable tendon arrangements which keep all motors and electronics off the limbs, resulting in a uniquely spare and autonomous impression. Carl Pisaturo has been a practitioner of the robotic arts since 1995. http://carlpisaturo.home.mindspring.com

William Linn is the founder and creative director of blasthaus, a multi-pronged organization centered around the convergence of art, technology and entertainment. In the heyday of 1997, when venture capital opured into almost everything "high-tech," he decided to go in the opposite direction with a project called BOLT (Bureau of Low Technology). BOLT celebrates obsolescence to point out the merits of simplicity and free access, while also reconditioning dead media to create "technostalgia". BOLT encourages people to get off the treadmill of upgrades and useless gadgetry and push the envelope with "forgotten" low technologies. He has a long-standing interest in how early video games like Pong played a major role in the adaptation of high tech nology into everyday life, while forever freeing the television from being a one-way directional media Installations by BOLT have occured in galleries and museums across the USA. http://www.blasthaus.com

David Cox's short films examine the interplay between technology ,humanity and the creative spirit. We'll see four of his films.:

"Puppenhead," a stark film made using stop motion, combining eery puppets with live action to tell a tale in a climate of political paranoia and oppression.

"Otherzone" combines live action and computer graphics. It's a tale of murder involvind a massive telecommunications corporation - MAN - the Machines All Nations Corporation.

"Tatlin" is a one minute essay on the life and work of Vladimir Tatlin, the constructivist artist whose inventions included a massive tower which would have been three times taller than the Eiffel Tower and would have used up all the steel in Russia!

"BIT" is about the legendary "Bureau of Inverse Technology" - an all-girl trio of cyberfeminists who scale buildings and use technology in ways which show up the unequal power relations in our society.

David Cox is a film maker, digital media artist and lecturer in digital screen production at Griffith University in Brisbane, Australia. For more information on David Cox and his work please see:

http://www.netspace.net.au/~dcox/dcox.html

Check the YLEM website!
http://www.ylem.org

Contact: Trudy Reagan, 650-856-9593,
trudy.myrrh@stanfordalumni.org
Complete information listed at

http://www.ylem.org/NewSite/news/Forums.html

For an up-to-date calendar of events in the arts and sciences please visit our web site: http://www.ylem.org and click on "events" and then on "events." For more Forum information click on "events" and then on "Ylem Forum Information."

Ernestine Daubner

L.H.O.O.Q.: LOOKing Towards Digital Interactive Art and the Dialogical Eye/I

L.H.O.O.Q. / LOOK, says the caption. I am being addressed here! Instead of LOOKing through the transparent window of Leonardo's canvas onto a transcendental world of sfumato effects, onto nature's reflections and counter-reflections, I SEE a strange, androgynous figure LOOKing at ME. Her enigmatic smile is farcically encircled by a hairy appendage. I am told, in carnivalesque fashion, that the demure bride has a "hot ass." With resounding force, my distanced, contemplative gaze upon a world "out there" is disrupted. Irony, humor, ambiguity dissolve the aura of universal, transcendental


Marcel Duchamp, L.H.O.O.Q. 1919

Tableau with Nude
Marcel Duchamp, Étant donnés: 1E la chute d'eau, 2E le gaz d'éclairage

Rectified Readymade, Pencil on a Reproduction (73/4 x 4? in.)

meaning.

With no authorial voice to guide me, I am obliged to create my own meaning. And so I do. LOOKing beyond L.H.O.O.Q., I SEE how Duchamp, as an artist situated at the end of the modern era, has inscribed his various works, words and gestures as a complex network of recurring and cross-referential signs that tend to link together and dialogue with each other. As with an interactive hypertext, my dialogical eye/I is elicited: I am invited to make my own connections...

Miro-ic
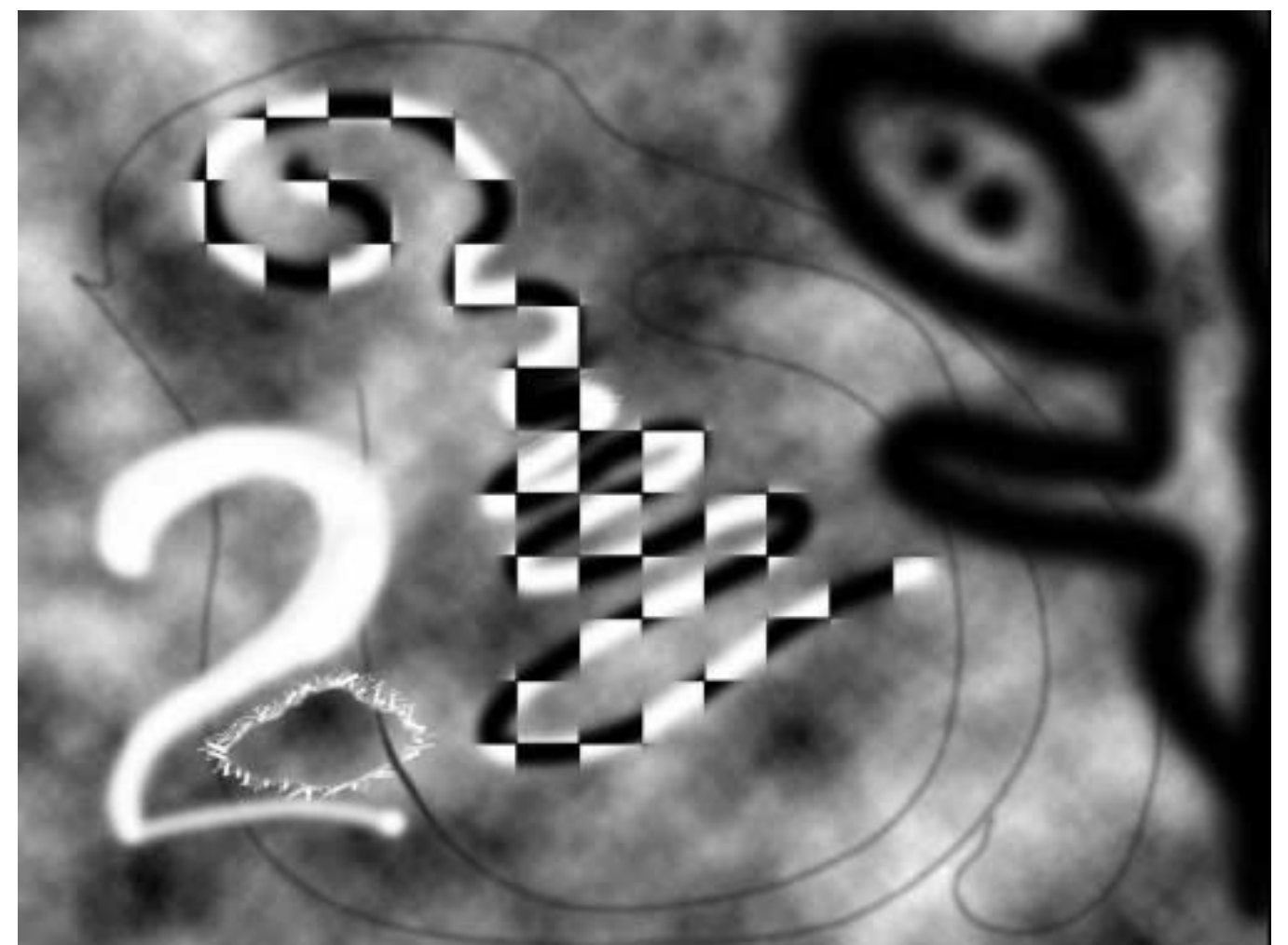
Web Pages of Interest:

www.museumofcomputerart.com

www.iacgr.com

www.digitalartsgroup.com

www.digitalartmuseum.com

www.toray.co.jp/artspace/e/dca/index.html

www.worlddigitalart.com

www.dunkingbirdproductions.com

www.itgoesboing.com

Folds Unchained

"Jungle Gym", by JD Jarvis using Adobe Photoshop. An example of how the computer can extend the photographic process, these digital snapshots are woven together in a way that would be nearly impossible in the dark room.

"Glass of Absinthe", (after Degas) by JD and Myriam Lozada-Jarvis using Corel Painter. We used an oil by Degas as a model through which we explored the simulation of oil paints with this natural media software.

"Guardian", by JD Jarvis using Adobe Photoshop and Corel Painter. Hard edges break up the ""gold leaf"" background and careful attention to drop shadows allows the rectangular form to visually protrude from the picture plain. The piece seems to stare back at you, stern and silent, a proper Guardian.

"Birth of the Egg", by JD Jarvis using Adobe Photoshop and Corel Painter. A complex application of filters including Kia Power Tools, "lens flairs," ""turbulence," "materializer" and "orbit" was woven together in multiple layers. Again, drop shadows play an important role in resolving the composition. The piece finally lays to rest the age old philosophical question, "which came first...

"Dream Seekers," by JD Jarvis using Fractal Poser and Bryce 2. The "sleepers" heads were created and arranged in Poser then imported into the Bryce cloudscape. Once in Bryce, spherical shapes had eyes mapped to them and these were placed along with virtual light sources to set the scene.

Raytraced rendering makes the final process a lot like making a photograph of this scene, which exists in the computer's virtual space; and is somewhat analogous to the "virtual space" of my own imagination.

"Paralaxium Family Picnic", by JD Jarvis using Ray Dream Studio, Poser and Bryce 2. An illustration from a short Sci-Fi story. Objects were constructed in Ray Dream Studio and Poser, then brought into the Bryce landscape for placement, lighting and final rendering. I realize now, the whole project was inspired by a wonderful trip to Japan.

"Carnival", by JD Jarvis using Kia Power Tools, Paint Alchemy, Adobe Photoshop and Corel Painter. This piece which combines bits of fractals, automated brush strokes, hand drawn natural media elements, layer effects and collage techniques received the Grand Prize in the 5th annual Toray Industry's "Digital Creative Awards"". Comments on this piece and a look at all the other entries are at: http://toray.co.jp/art-space/e/dca/index.html

"Miro-ic," by JD Jarvis using Corel Painter and Adobe Photoshop. I often ask myself what would this or that Modernist artist have done with the computer. This question proves to be a rich source of artwork and discovery. Here is one of many digital homage I have done to Joan Miro.
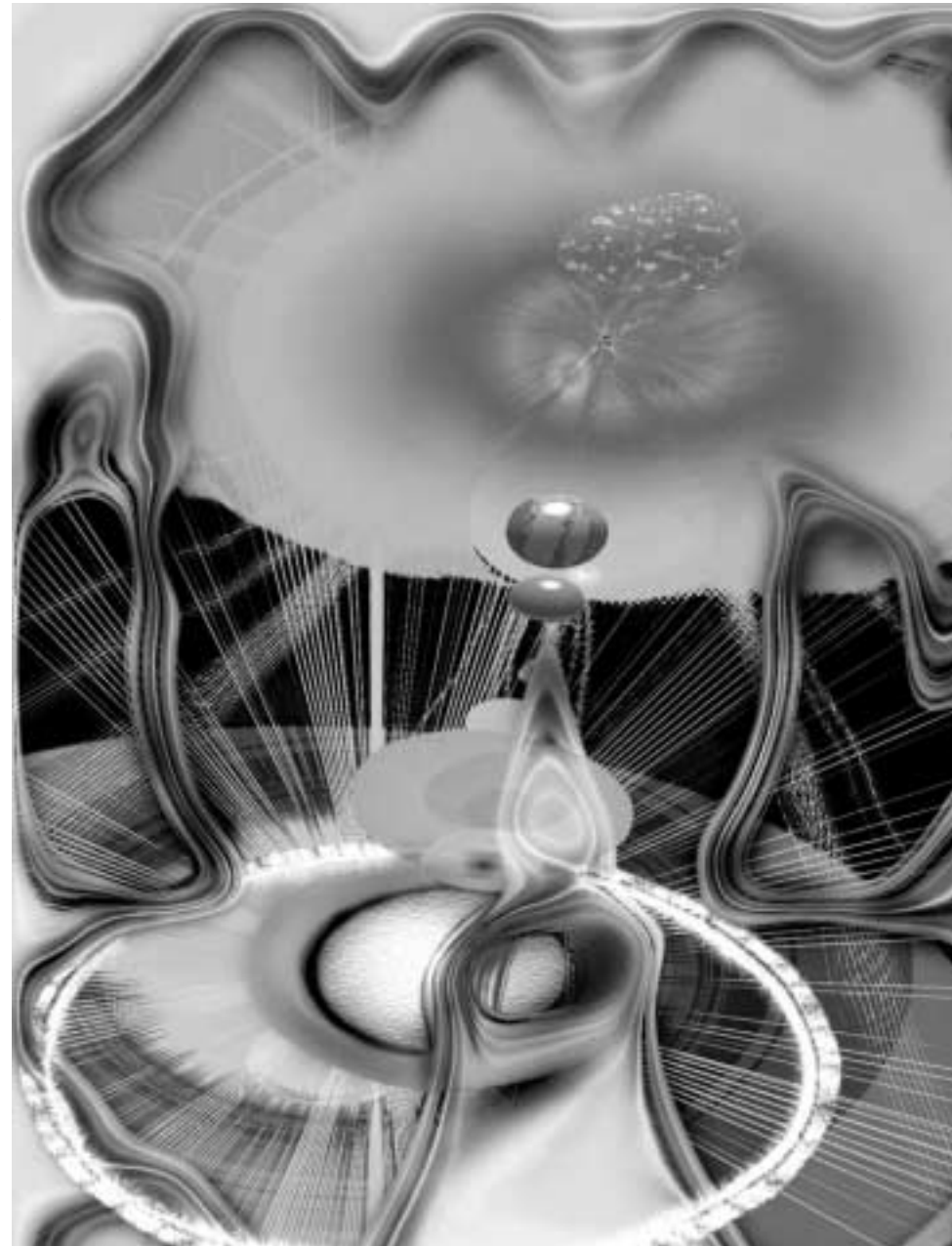
Birth of the Egg

A self- proclaimed "anti-retinal" artist, Marcel Duchamp looked beyond modernist rebellions. After all, shattering Renaissance perspectival space keeps intact art's status as an object of display, continuing to position the viewer as a distanced eye. True, Duchamp drew irreverent whiskers and a suggestive caption on a reproduction of a Renaissance icon (in French, L.H.O.O.Q. reads phonetically as, "elle a chaud au cul," meaning, "she has a hot ass"). Even so, Duchamp most certainly admired Leonardo, the Renaissance proto-scientist, the artist who, like himself, was decidedly "cerebral."

LOOKing at their respective historical positions, one can SEE how Leonardo and Duchamp are situated at opposite ends of the "modern" ocularcentric spectrum. Leonardo, the Aristotelian observer of the infinite workings of nature, signaled a resolutely "modern" mindset based on the primacy of vision, and on the dichotomy between the observer and the world observed. By means of a few strategic pencil strokes on Leonardo's iconic image, Duchamp points to the end of this modern paradigm. He creates a different model – a model that displays strong affinities to digital interactive art.

CLICK, CLICK. Gazing through peepholes in an old wooden door, I am again positioned to LOOK -- this time at Leonardo's "shaved" bride, her "hot ass" now blatantly exhibited. CLICK. I connect her naked figure to a myriad of cultural inscriptions of the generic "woman" inscribed as nature, as body, as object of the scopophilic LOOK. CLICK. In my mind's eye, I SEE how Leonardo and Duchamp (along with countless other whiskered creators of the enigmatic "woman") pose as active agents of culture. I SEE the passive, faceless female persona as their "other," and realize how much their masculinist construction, "woman," serves to camouflage women's real identities and histories.

Do you SEE my own givens intimately interconnecting with Duchamp's givens? By LOOKing and CLICKing, my dialogical eye/I is able to create a continuous flow of links and dialogues. Invited to create the conditions for SEEing, I find myself IN the picture. This position, I SEE, dismantles the old border between the world and myself. Yes, Duchamp's network of interconnecting signs, like interactive digital art, dismantles the modern paradigm: the illusion of a fixed "unitary" object with an a priori meaning that precedes me.

Door
(Given : 1. The Waterfall, 2. The Illuminating Gas) 1946-66. Mixed-media installation (approximately 95 1/2 in. high x 70 in. wide)

Ernestine Daubner, PhD, is interested the relationship between Elightenment culture and contemporary art and new technologies. She is an assistant Porfessor in the Department of Art History at Concordia University, Monreal, Canada. daubner@vax2.concordia.ca

Barbara Lee Williams

Aesthetics and Ethics: Moving beyond Technology in Internet Art

Since its emergence as public forum, the web has provided a liberating venue for artists whose work might be excluded from traditional art institutions.Yet, it has taken persistence and innovation for these artists to come to terms with the evolving, if characteristic, aspect of this venue: technology itself. Often they fail: much online art is simply the placement of old media in a new locale. Meanwhile, other works abandon traditional concern for aesthetics to focus primarily on technology -- particularly interactivity -- or on conceptual play.

Nonetheless, some artists seem to have grasped the potential of web art without abandoning aesthetic form altogether. In "Present," photographer David Claerbout created digital images of three flowers (pink amaryllis, yellow gerbera, and a red rose) for viewers to download to their desktops where each flower "lives" for a week, first "blooming" then "dying." With this obvious reference to mortality, Claerbout uses Internet technology to impart symbolic meaning, even if the images are unimaginative and the content simple, at best.

A more provocative example of web content was created by Jenny Holzer, whose theater marquis and digital billboards have long provoked us with statements like: "ABSOLUTE SUBMISSION CAN BE A FORM OF FREEDOM". However, in "Please Change Beliefs," Holzer denies the necessity of aesthetic form for her ideologically potent content. The interactive work invites the viewer to alter a slew of truisms in simple typeface, including: "ABUSE OF POWER COMES AS NO SURPRISE," "YOUR OLDEST FEARS ARE THE WORST ONES", "A LITTLE KNOWLEDGE CAN GO A LONG WAY", etc. The results are humorous and suggestive: e.g. "A LITTLE IGNORANCE CAN GO A LONG WAY," "A LITTLE KNOWLEDGE CAN GO A SHORT WAY, "A LITTLE KNOW- LEDGE, A LONG WAYS." Holzer's project is intellectually and politically compelling but non-aesthetic. She has acknowledged the success of the piece claiming that many viewers' transformations of her truisms are improvements on the originals. Yet despite its addictive interactivity, this web work is bereft of the immediacy and color of Holzer's digital billboards where the animation enhances the provocative texts.

With increasing frequency, other Internet artists are merging mesmerizing aesthetics with revelatory content. At his web site, "Mongrel Tate," Graham Harwood uses technology as the means to an end: works of art open to everyone with Internet access, art that makes you "Look again, think again." The Ideological thrust of Harwood's work emerges in his blunt, concise prose: "The Tate (museum)'s scrapbook of British pictorial history has many missing pages, either torn out through revision or self-censored before the first sketch. Those that did make it created the cultural cosmetics of peoples profiting from slavery, migrant labour, colonization and transportation . . ."

But the heart of the work is in the brilliant, jarring photomontages. Hear Harwood grafts the grit of contemporary life onto "High" art: Hogart's exquisitely subtle portraiture is merged with hyper-realist photos of Harwood's aged "mum"--her tired eyes and pores of her worn skin vivid and silent accusing. "Mervin and Slaves throwing overboard the Dead and Dying Typhoon coming on after Turner 1840-2000," a compostion of paint, dirt and crusted sores, mesmerizes with its blend of textures and color, while snaring us intellectually with Harwood's acerbic historic notes on culture, power and servitude. Though the texts are articulate and potent, it is the visual component--Constable, Copley, Gainsborough reconfigured--that most communicates the artist's pain and passion.

Harwood deigns to employ technological "bells and whistles"--there are no spinning icons of layers of sound--but his digital aesthetics are vivid enough. His work reminds us that here, in this most democratic of viewing places, where curator and dealers yield to artists form is still necessary to exploit content to its fullest. If we are lucky, more artists will use the internet, along with their bold imaginations, to similarly stir our minds and pierce ours hearts.

Upper: Graham Harwood, *Hogarth, My Mum*, Lower: *Mervin and Slaves...*

Claerbout: www.diacenter.org/claerbout/index.html
Holzer: adaweb.walkerart.org/project/holzer/cgi/pcb.cgi
Harwood: www.tate.org.uk/webart/mongrel/home/default.htm

Barbara Lee Williams is an art critic and lecturer in Art History at Dominican University. Her work has been published in "The Threepenny Review," The Southern Quarterly, "Artweek," "Leonard," and "The Christian Science Monitor."
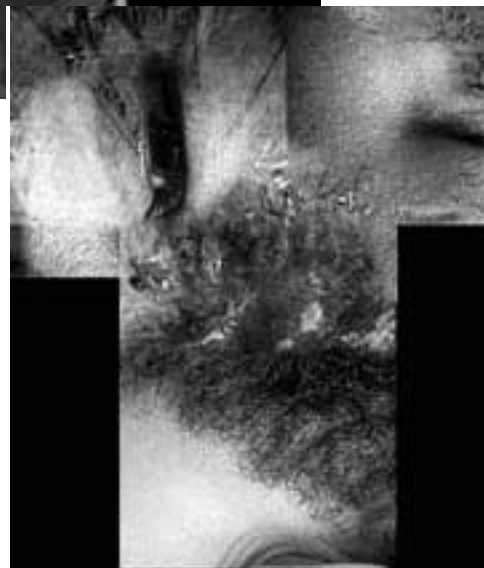
DIGITAL MEDIA.Beyond photography and paint, past the algorithms and automation there lies the true power of digital art technology, the power of synthesis. If we are to see a new art form emerge from this pervasive art making tool it must come from this inherent capability. In this synthesis, we feel the voodoo reality of a photograph's stored energy of time and place. We see the sensual delight of natural texture, color, line and form. We experience the shock of infinite math as if looking into the face of a god. We realize this synthesis not as individual categories of art, but interlocked into a singular beauty. The art that emerges from the genre of "Digital Media" is revealed to us in a never before seen mixture of photography and paint, of man and machine, of pixel and light made solid. What is important about working digitally is not in the replication of traditional tools, nor the expansion of existing processes. What has been and will always be important in Art is creative evolution and the age-old question, "what's new?" The strength of computers lies in synthesis, in bringing together existing forms in such innovative ways as to yield completely new ones. What is truly "digital art" is the work that begins in the mind of the artist with this notion of synthesis. Using all the software tools and all the traditional processes together to make something that has not yet been imagined.

Consequently, the software, the tools and the processes disappear and we discover that, after all, the force of human imagination and invention is driving it all. Digital artists are simply those who have discovered that we live in an amazing time when the depth of one art-making tool can address the potential of this ancient driving force.

Notes on the images

"Mossy Glen" by JD Jarvis. An experiment in adding chance to a digital composition, this piece originated as splash and drip shapes created with paper and ink in the backyard and then scanned into the computer. Of course, Jackson Pollock, was forefront in my mind, but I feel the layering, shadowing and gradient color that was added may have pushed this essentially "abstract expressionism" into a more personal statement. The deep colors off set by the active field of black ink, now turned white for this composition, reminded me of a woods where we played as children, "Mossy Glen".

"Folds Unchained". A prime example of "Machine Art" lead by a human eye. Several layers of fractal images interact to create those ponderous fleashy folds that seem to be uncontainable by the metalic and slightly rusty appearing ornamentation. Hand guided highlights, shadows and detailed textural work personalized and brought the otherwise "accidental" compostion into solid focus and gives the piece meaning. As with all "Machine Art" my role as artist is to remain open to suggestions made by the process and to reject or explore the avenues that open up. Usually, with this sort of work, as soon as a title occurs to me the procees gels and the work is near completion.

"Land of the Egg," using Corel Painter. A collage, as well as, a homage made of images taken from my "mediated environment." Such material is so facile and pervasive today, prompting the possible expansion of copyright laws to include such works. Should the original photographers, whose work I scanned or Magritte, himself have concerns? Or, have I created an original work? I am grateful for their inspiration.

lenging and the edgiest work because it entails the artist turning over control to the process. Machine Art is the imagery of the computer's virtual soul, never before seen and at the same time so familiar to the forms we see in nature and the shapes we sense behind closed eyes. There is definitely something there and the bravest among us explore it. By tackling the problem of integrating a computer's imagery with a human's vision, we stand the best chance of creating something we have not yet seen.

A subset of the "Machine Art" genre lies in the area of 3D modeling. This advanced software can deliver believable and sometimes astounding visual replicas of landscapes and cloud filled skies. In the least, such work falls into the area of photography. At best these tools can be used to call forth virtual sculpture and with further creation and placement of lighting sources and simulations of interior space; virtual installations open for one's exploration are constructed. The creation of a synthetic world space, the control of lighting and environment and the ability to move one's point of view around inside this self-contained world is highly seductive. Perhaps it is our own messianic tendencies but, the longer one works inside one of these worlds the richer and fuller that world becomes.

Constructing a 3D digital piece is much more like visualizing a cyber novel. Artists who stay too long in these environments invariably come away with names for the places and the creatures they have created; with elaborate back stories and even full blown mythologies. And so the humanness in 3D modeling work comes in the back door with the stories these images represent and not necessarily in the visual presentation, itself. This cyber novella may actually represent a new literary form and not just a somewhat stiff and cold visual work of art. So, alas, it appears even when we do create art from that which is totally unique to the computer something important is lacking.

Trying to put my finger on just what it is that I feel lacking in "Machine Art", I recalled an experience from my Video Art days. This particular project involved letting the toss of the dice decide the organization and mixing of imagery on the screen. I chose a piece of music created by John Cage, which had been composed in a similar chance driven fashion, thinking the combination would be a natural. In the course of the final mix, I discovered that the dice had determined that everything come to a halt. So, as the music raced on, my

"kinetic light structure" consisting of six interactive layers of textured and colored light just sat there for nearly thirty unbearable seconds. I was stuck because, conceptually I could not alter the piece and still have it be random, so I basically had to create some "art" I hated. It was there that I learned that I am primarily a sensualist and an artist that was ultimately interested in creating visual poetry for human beings and not for the delineation of cold concepts. I have had my hand in the machine and my passions in the process ever since. Thus I was led to the realization of one final genre within Digital Art.


Mossy Glen

Paul Hertz

An Art of Ideas

Recent shows at the Brooklyn Museum of Art, the Whitney, and SFMOMA have attempted to show the impact of computers on art. While the art world, as typified by these institutions, has fortunately moved beyond identifying pixelation as the signature of digital art, much of what it terms "digital" might more correctly be termed "digitally mediated." If PhotoShop or FreeHand or software of some sort was used, the reasoning seems to go, the work must be digital, and if it's digital, it must say something about computing.

While such an approach does begin to reveal the impact of digital technologies on media production, missing or barely sketched in these shows are many of the themes presented in art at SIGGRAPH, ISEA, Ars Electronica and other digital media venues. Complexity, a-life, artificial intelligence, algorithmic processes, data visualization--all areas where artists have been mining the same lode as scientists, but to different ends--are barely visible in the art world. Although digital audio sampling and digital image collage are now accepted as means of art production, their use does not necessarily reveal anything about computing. Both are a simulation and extension of prior analog technologies and both operate too far downstream from raw computational operations for these to appear in the end product, unless an artist consciously exploits low resolution to provide a "digital" stylization.

It could be argued that the aesthetic of the computational processes I have alluded to is not artistic, but technological or scientific. If one observes, for example, the history of the SIGGRAPH art gallery, there's even a degree of justification for this viewpoint. Early digital art often presented the aesthetic quality of a technological process. Often it was an offshoot of scientific research: someone found computing beautiful and little cared if it fit contemporary art practice. One could consider this a naive or primitive point of view; however, it was by no means unsophisticated. The people who produced it were extremely sophisticated, and their work often presented ideas of startling originality. Most art at
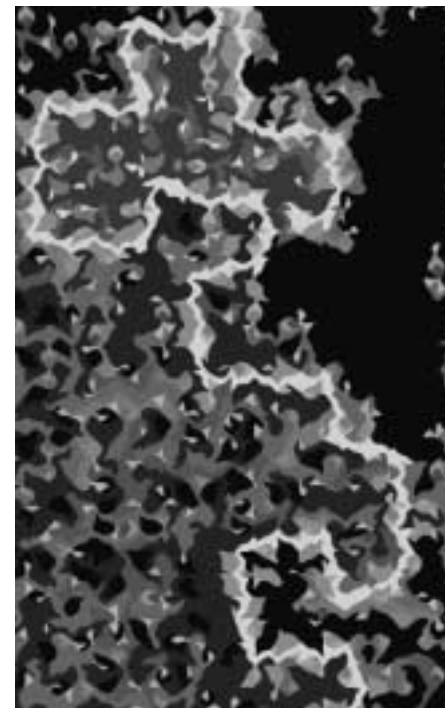
Anytime Now

SIGGRAPH no longer reflects this point of view, but the continuing presence of "primitives" is one of the more interesting aspects of the show. In a sense, it confirms that digital art is still an "outsider" art.

Why is this the case? Start with an art market that is still addicted to novelty, despite the demise of the avantgarde over a generation ago, and its consequent demand for styles and "art stars" that can be categorized in a glance. Add to this the reluctance of most curators, critics, and art historians to leave the confines of artistic discourse to study the formidable apparatus of scientific thought and technology, and it's easy to see why the most sophisticated ideas that computer art has presented historically are largely absent from the art world.

The issue is further complicated by the nature of computational devices. We design our tools to be extensions of ourselves. We have endowed the computer with our talent for mimicry. It's the first tool of its sort, a meta-tool. Its productions bear no unique quality, no single sign of identity or style. Given its protean nature, it would be absurd to fit it into the modernist "cannon" where media express their "essential" qualities. But despite the numerous historical ruptures with the "cannon," it still has market clout because it produces superficially recognizable styles, highly desirable in a commodity. The deeper aspects of computation may not have anything to do with such surface identifiers. They demand a new visual literacy that in this situation, artists who work the deeper fields of computation will have to discover and educate their public.

They will have to assume the roles of art historian, curator, and critic. Though they will find some allies there, the art world is not going to do it for them. This is not unlike the situation in contemporary music. Despite its frustrations, it is probably a very healthy situation for art. Meanwhile, the art market may be less and less important, in no small part because digital media can circumvent its distribution strategies. There is still hope for an art of ideas.

Paul Hertz is an artist who designs networked multimedia applications for the Collaboratory Project at Northwestern University, where he also teaches in Department of Radio, Television and Film.

Jack Ox

Visualization is a metaphoric process where one must first create or find the visual equivalent of that which is being recreated structurally in the new language. This equivalent must be able to accommodate a significant number of attributes found in the visualization source.

During my twenty-five years of music visualization I have developed multiple sets of visual metaphors that are used as the vocabulary upon which the structure of the music is applied. I worked with very clearly painted or drawn images of landscapes and/or architecture containing historical and/or structural relevance to the source material. These very explicit figurative images were cut up and collaged into patterns derived from analyses of the source material such as pitch, edges between the different sounds (e.g.. legato, pizzicato), spatial units translating time and therefore rhythm, and later, phonetics. If the rhythm of the piece is quick with many pitch changes, then the images become very transformed. However the metaphoric quality of the original images live on as a kind of unconscious base. Because the collaged images are repeated, as sections of a musical theme are, the information contained in the subliminal form becomes more familiar and therefore clearer.

I began the 21st C. Virtual Color Organ in 1999 with David Britton as my programmer collaborator. The Organ is not a visualization in itself but rather is a visualization instrument capable of producing multiple works. It is a continuously developed virtual reality, immersive environment which will consist of a number of "organ stops" (that is visual organ stops). At this moment there is only one completed visual environment and vocabulary, which is the definition of a visual organ stop. This environment is a landscape composed out of eight different desert land formations I photographed in Arizona and California. Each one is metaphorically connected to a family of orchestral instruments: Stringed instruments are represented by a mountain range on the floor of the desert which could have been created by a mapping of bow movements, while brass is a sandstone formation with smooth surfaces and holes formed by wind blown, sand encrusted air.

Vocals are pictured by rock formations from Arizona which look like a chorus or vocal chords. Percussion instruments with keyboards are represented by an erosion pattern on a tall ridge of solidified sand moving sequentially from taller to shorter, like the strings inside a piano. A rock garden serving as the surfaces for many petroglyphs is a metaphor for percussion that one hits, e.g. a set of drums or a triangle. This organ stop may be used for any piece of music which is timbre based in its structure. 1 The original two dimensional drawings are embedded in polygons, created by the MIDI files of the music, in real time as the music plays. Over the image is a transparent color defined by a detailed analysis of the timbre. There are over 130 rgb
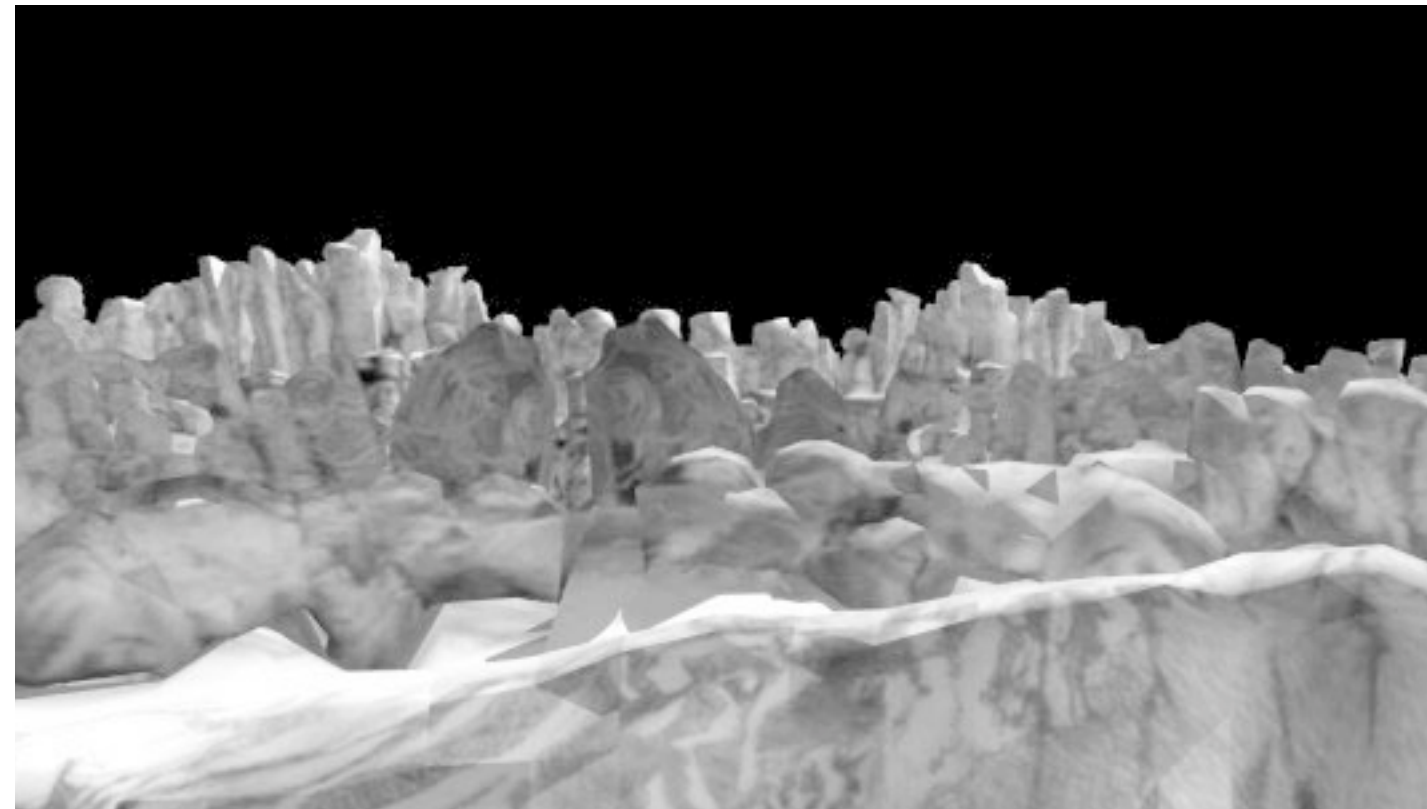
patience. For this reason alone, digital works should be the best, most extensively explored and polished compositions in Art. And, for the most part, any time saved utilizing digital tools goes back into this very exploration. We have discovered that it takes just about as long to produce a piece digitally as it did traditionally. The difference is that the time gained from processing light instead of manipulating material goes back into exploration of form, experimenting with color and tweaking composition.

But, what of accident, the effects of gravity and chemical resistance of physical materials? Indeed we lose something when dealing with virtual materials. Accidents of gravity and material interaction must also be simulated, even rendered by hand, with digital tools.In that process, it seems spontaneity is lost. This was one of my chief concerns when moving into a digital studio. Having depended for so long on the vagaries of splash and drip and the degree to which I allowed chance to suggest the evolution of my traditional acrylic painting, I feared something vital was going to have to be left behind. The answer to this concern came in a very unlikely form, which I have ultimately recognized as another genre within Digital Art.

MACHINE ART…Given the integration of photography and traditional graphic means into the digital palette, artists look deeper into the digital tool for means of expression that did not exist before the invention of the tool itself. We ask, what is it that this tool does that no other can? We find an answer in integration and iteration, the ability to compute and to plot pure data into a graphic display. While this seems an unlikely source of "chance" or "accident", multiple applications of algorithmic driven filters and fractal generators do provide plenty of surprises that can be altered or integrated into a digital composition. The age-old dance between the artist and the materials, between the maker and what is being made, survives in the virtual and accelerated environment of pixel and bit. As the "digital painter" ventures beyond traditional tools, we see more and more work that mines this rich visual field.

But, there are pitfalls. The risk is that taken purely in and of itself this sort of imagery hovers on the edge of appearing trite or at least lacking in human warmth. Critics say that this is the nature "machine art" where artists do nothing to achieve the image short of "point and click". But, to the contrary, Machine Art is important for these very same reasons. It is the most chal-


Piano
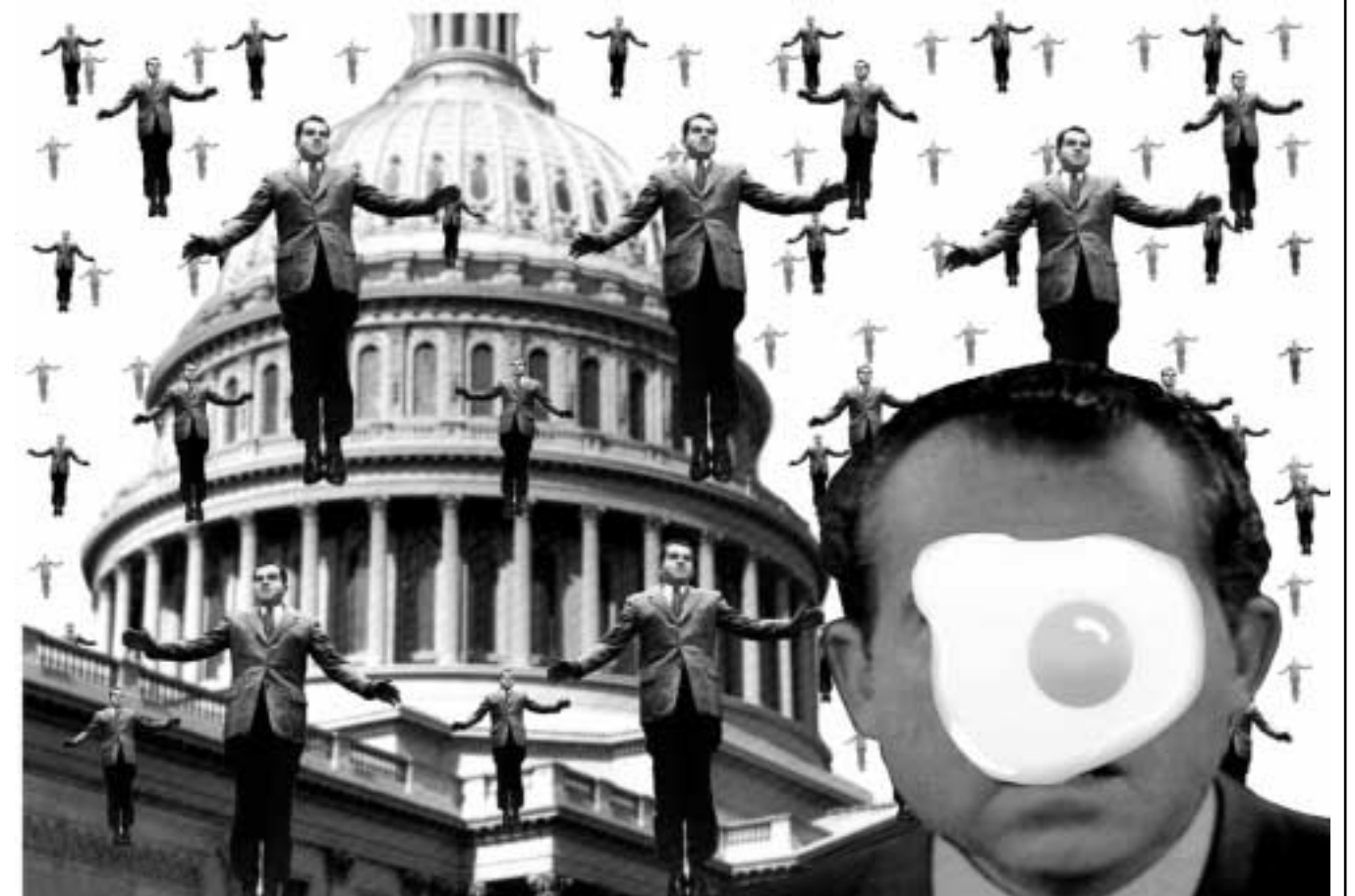
Land of the Egg

Jungle Gym

PHOTO-MANIPULATION...Photography presented the world of Fine Arts with its first "point and click" dilemma. How could anything so mechanized and so available to the common man be considered a "High Art"? Fine Art Photographers have fought long and hard to gain acceptance for their medium for no other reason than the apparent ease with which photographic imagery can be accomplished (especially when the drugstore does the printing). And, this prejudice for mechanized art making has carried over to Digital Art (in part thanks to the software salesmen claiming "Art" is just a mouse click away). But, anyone who has actually sat down at a computer and been able to achieve, in a well lighted space without once getting your hands wet, all the classic cropping, exposure adjustments, color tinting, selective focus... of traditional photography knows first hand the meaning of "increased creative bandwidth".

The associated genre of Collage for example will never be the same. The digital integration of disparate photos has become so seamless that the term "collage" has been augmented by a new term "composite". Photographs are so malleable now as to be instruments of sheer poetry. Coupled with the photograph's acculturated ability to both represent and even replace reality the fuse of Surrealistic imagery has been relit within the world of Digital Fine Arts. "Reality" as it is represented in photographic imagery is no longer sacrosanct. The camera lies quite skillfully and "seeing", rather than,

believing"; is much more akin to "dreaming".

NATURAL MEDIA...This classification of digital art springs from specific graphic software with the ability to mimic the behavior and appearance of traditional painting and drawing materials. Input via a pressure sensitive tablet and drawing stylus preserves the expressiveness of the artist's eye and hand, as well as, the appearance of oil paint, charcoal, acrylic air brush, pencil, pen and many more traditional "mark making" devices. The final image is built up over time, mark after mark and layer upon layer of pixel pushing until a satisfying result is achieved. Not to get too carried away, one should rightfully ask, if watercolors and brushes still work, why use a computer to make a watercolor-like image? Essentially, what does a computer achieve that traditional materials cannot? An answer lies in the computer's storage, recall and iteration capabilities.

Consider how precious a painting becomes as we approach its completion. After weeks or months of work, it is easy at this stage to put off that flash of creativity that challenges you to risk a maneuver that may destroy the entire piece. Digitally there are no precious materials to gamble, no work to lose. The ability to record then "undo" procedures or to save and revert to an earlier version of the work allows further experimentation without risk. Digital artists can push a composition further and continue to explore and experiment with the visual statement almost indefinitely, limited only to one's imagination and
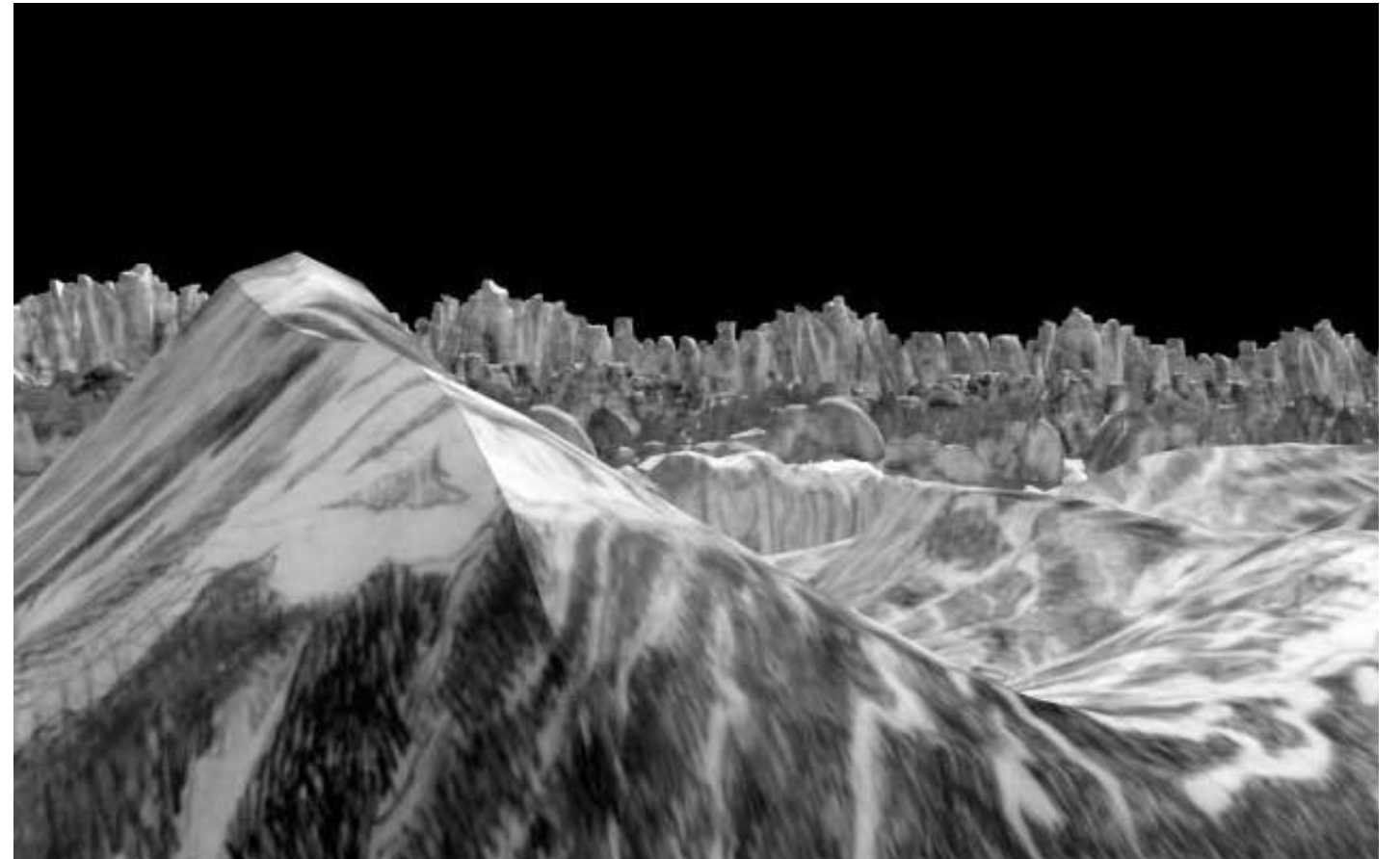
Strings

mixtures which compose this part of the visualization language. When the music is finished, a frozen sculpture remains suspended over the original 3D hand-drawn, black-and-white landscapes.The same source is used for the environment and the visual vocabulary.

The above described metaphorical relationship will be used in visualizing Clarence Barlow's timbre based composition, "Im Januar am Nil." The Color Organ will also be used in a "GridJam"[2], to be musically structured by Alvin Curran. Even though we will be using the same desert environment and vocabulary as before, the metaphor will have changed completely. Alvin has been collecting/creating a vast library of sounds for many years.

The sounds are MIDI files which are accessible by MIDI keyboard. Instead of the previously described metaphoric relationships Curran's sounds will be sorted into eight sets through a process of listening and finding similarities and differences. Each of these sets will be connected to one set of landscape images because of the qualities of the group of sounds. The metaphor is now about mathematical sets; one group of objects associated with another because of the interior relationships of the objects comprising the set. I have tried to show how wide the range of metaphorical possibilities is. These relationships can be absolutely abstract or come out of the life of the composer, and still include structural characteristics of theme material. So metaphor can range from the extremely explicit to one based on very abstract structural principles.

Footnotes:

1 The structure comes from the overlaying of different sounds.

2 GridJam is a Jack Ox concept which has geographically separated MIDI-playing musicians jamming together in immersive environments. They are located in different spots on the AccessGrid, the supercomputing wide band Internet.

Jack Ox is the co-creator with David Britton of the 21st C. Virtual Color Organ. She will have a one-person exhibition in the Muzeum Sztuki in Lodz, Poland, next year. Ox has been on the Leonardo editorial board for over 10 years. Recently she co-edited a special section with Jacques Mandelbroijt on "Intersense and Synesthesia."

TORREY NOMMESEN

INTERVIEW WITH ROBERT J. KRAWCZYK

Robert J. Krawczyk is on the faculty of the College of Architecture at the Illinois Institute of Technology. During his nineteen years at IIT, he has developed and taught a series of CAD and digital design courses covering 2D and 3D CAD, and is currently teaching image composition, animation, and form generation methods. In addition to teaching courses, he is an advisor in the PhD program on form generation, fractals, 3D blob modeling and other related digital design methods.

His work is currently being shown at SIGGRAPH 2001 international Traveling Art Show for the next 2 years (www.siggraph.org/tas/#TAS01) and his images are included in "Fragments of Infinity: A Kaleidoscope of Math and Art," by Ivars Peterson, John Wiley & Sons, 2001. His work will also be included in the upcoming show Computer Art International 2001, Rolland Art Center, February 2 to March 2, 2002, University of Saint Francis, Fort Wayne, IN. Recent exhibits are at www.netcom.com/~bitart/spexhoo.htm, and more of his work is at www.netcom.com/~bitart

This interview was conducted via email by Torrey Nommesen.

Torrey Nommesen: Can you tell me a little about your background and how you got into making spirolaterals?

Robert Krawczyk: My education is in architecture and I have been consulting and teaching computer applications to architects for about 22 years. I wrote my first graphics computer program about 25 years ago. Over the years I have taught [classes in] word processing, 2D drafting, 3D modeling, digital composition, computer programming, web design, [and] animation. About 7 years ago I started researching fractals and how they could be used to generate or suggest architectural forms... At about the same time I encountered spirolaterals, generated a few and then left them. Most of my time was spent teaching and consulting. When my teaching load decreased, and after meeting Javier Barrallo and Nat Friedman at Mathematics & Design 1998, I found a group of people with common interests which resulted in my looking at the spirolaterals a second time - again from an architectural focus.

At the next few conferences, I examined the mathematical background of generating spirolaterals. All the images I was producing were single line drawings.

Somewhere along this investigation... the idea of increasing the line thickness was tried. The spirolaterals then took on an artistic interpretation that I never noticed before. I
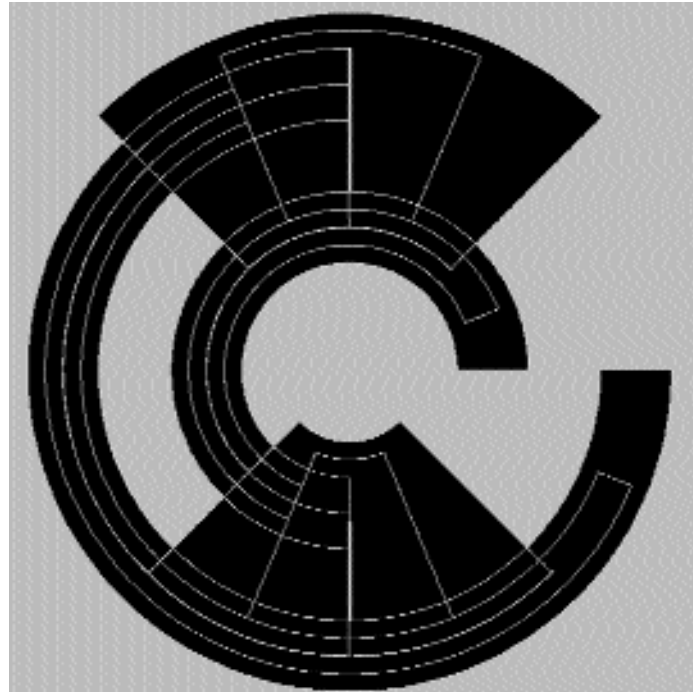
rewrote all my software to account for the thickness and started to generate as many [spirolaterals] as I could.

When I ran out of [regular] spirolaterals to try - I tried 100's, keeping over 300 of them - I thought that an interesting variation would be to try to curve them. This brings me to the last year or so. The progression of curving started with curve fitting and splines, to transformations that now include hypocycloid curves, epicycloid curves, antiMercator, circular, normal and harmonic mean inversion. I have found and had suggested to me about 10 other transformation I might try.

Over a year ago, I also started to look at three dimensional possibilities and have developed a 3D series, but I am still working on them. My overall goal is to return to forms that suggest architecture or are at least sculptural in nature.

TN: What was the climate like for computer graphics programmers when you first were writing programs?

Krawczyk: Two items come to mind - one is the technology, the second is the feeling that everything you did was new... Information of what other schools were doing came only through journals and conferences... All of the graphics work was in basic technology and not that much in applications. The first graphics programs I wrote were ones that used the printer characters as the painting tool. [This was] most likely influenced by the early work of Ken Knowlton. Pen plotters were difficult to find.

work one encounters appears to be rooted in photographic explorations is to be expected given the history of the development of digital art making tools.

Unlike most every other art making medium, "Digital" got its start in the commercial art world of magazine and advertisement layout. Most of this work involved the manipulation and preparation of photographic images. But, it also involved Typography and herein lies an important analogy to a prevailing strength, as well as a possible source for the contention some have with digital art making.

Before the computer, typographic manipulation was a mind numbing and tedious task. After the computer (and much to the chagrin of the old school) everyone could "play" with type. The machine kept the lines sharp, the columns straight and sizing and spacing was automatic. The Xacto knife, pica rulers and mechanical drawing pens were replaced by keyboard and mouse and young punks were "experimenting" with type.

Almost overnight, anyone with a MAC and little or no knowledge of the "do's and don'ts" of typographic design, was creating exciting and fresh typography. The purists wailed that the computer fell short in the ability to make minuter kerning and other spacing adjustments, therefore the quality of the type sufferd; but these complaints could not deter the art director who could now resize, replace, colrizeand distort type instantly experimenting with new designs almost on the fly. The creative bandwidth was incsreased exponentially and creativity and the ability to innovate won out over old-guard precision.

This is what is happening in Fine Arts and will continue to happen as more and more people "play" with images on their computers. Rules have been broken and overlooked and just like those earlier days of typographic exploration some awful and even unreadable work is created. But, digital tools have irreversibly expanded the creative bandwidth of nearly all the Arts in which these tools are employed and in the process usurped established materials and traditional techniques while democratizing access to an individual's inner creativity. "Democratization"..."usurped traditions"...

"exploration" this is not the stuff for squeamish individuals sitting safe and content inside a blanket of dogma and self-fulfilling rhetoric. Since unfamiliarity breeds fear, a basis for the negativity a digital artist must currently surmount is clear. And so, the first genre of two-dimensional Digital Art made itself clear to me.

Glass of Absinthe (after Degas) by J.D. Jarvis and Myriam Lozada-Jarvis

J.D. Jarvis

The Machine and the Eye

Digital promises to be different. And, it was not long after establishing our electronic studio that my wife and I

Dream Seekers

realized the extent of the vacuum that exists in the critical understanding and appreciation of original art work created and printed digitally. In order to fill that vacuum and provide a basis for my own visual research into the art making potential of these tools, I set out on a course of research seeking to establish and illuminate the various genres of digital art that I saw developing and to integrate this with my personal view of art history. It appears that digital artists have a lot of explaining to do. A good place to begin would be to ask, why?

Not since "Photography" has a new art making device required so much re-tooling of critical rhetoric, or caused such a stir of negativity among squeamish gallery owners and museum curators. The fact that a majority of

I did very little work in 2D art type images. I remember one project I did for an art class, a series of random squares on many pages of greenbar computer paper, [I was] spending most of my time trying to write programs to do 3D modeling and perspectives. I was not that aware of the computer being used for art, I was mostly tracking what was happening in architecture. I [started doing] that at school first (University of Illinois at Chicago) then at the architectural office I worked at, C. F. Murphy Associates, now Murphy/Jahn. Helmut Jahn is a very prominent architect and I had an opportunity to write a variety of software for what we would call visualization today. Except that all the drawings were done on a very slow pen plotter, no rendering, no hidden-line removal, just perspective wire frames. All the programs were written in Fortran, the programs and data were prepared on punched cards. There was no preview of the image, since graphics monitors were very expensive. There were no interactive graphics as we know it today.

I do remember one project a student did for me at a local community college I briefly taught at - it was a walk through of the architecture building on campus - about 100 frames. The data for the model and the viewpoint for each frame was punched onto cards, carried over to the computer center and processed... They were brought back over to the classroom, where a paper tape was made from them and then the paper tape was read by a flat-bed plotter to produce a single drawing [repeated 100 times]. The results were amazing. In essence we produced an 8 1/2 x 11 flipbook.

For my first years teaching at the College of Architecture at the Illinois Institute of Technology, I taught graphics programming. This was before AutoCAD. Once PCs arrived, [with plotting and 3D programs] my time was spent teaching applications with these packages and assisting architectural offices to do the same.

TN: How would you describe your work in the context of fine art? Where is the artist's hand in your work, and how important is it in the process

Krawczyk: In the last few years my greatest influence has been the work of Sol LeWitt. After I saw one of his wall paintings for the first time, I went home and wrote a JAVA program to mimic the concept – it's on my web site (www.iit.edu/~krawczyk). I can closely identify with his approach to developing the concept and instructions, and then having his crew actually produce the work itself. I also can identify with the working out of variations and enumerations of possibilities of a single concept as he does. This very much works with my architectural education. LeWitt has not written very much, but [in] one set of thoughts he [wrote]:[1] if you were to replace his word "draftsman" with "computer program" it would, at least to me, still make sense. I only write the instructions, I do not actually do the artwork. I then judge the results and modify the instructions. So for me the resulting artwork does not have as much value as, I hate to have to say this, the computer program I wrote and the process I went through to get some specific result. In doing this, many times, I do not know where I am going; I follow each interesting variation. This I find very exciting. In a perfect world I would like to write the program, put it up on the web, have a viewer create their own image, and then have some third party print it and frame it, and of course, collect some money.

TN: What first impressed me about your work was that it seemed like something deeply symbolic, something you might see as a tattoo (the brown tones helped to give this impression). I reacted more to the circular spirolaterals with sharp edges and variable line width rather than to the rigid straight-line spirolaterals.

Krawczyk: I was very surprised and pleased to see that the images that were produced by curving the spirolateral were ones that seemed to be familiar to me, not copies of

ancient ritual symbols or such but that could belong to a family of known symbols. I have a number of books on symbols and ornamentation, so I had some reference point in my mind. Now the question arises - do I pick images that are pleasing to me because they [are] based on my educational and visual experience or am I really seeing something new? Is anyone able to judge a new aesthetic that is not based on one's past experience and visual history? If I continued to investigate and develop images based on mathematical concepts - because of me - will I ever find something more new and exciting? That is why my web site has a JAVA program that anyone can generate their own image - because I know which ones please me, they may not be the same ones that please you. As a matter of fact, before

the SIGGRAPH final entries, I had four of my PhD students review over a 100 of the images and pick for me the 10 that pleased them most. I only used half of their choices.

There is also a sense that the natural beauty of mathematics should be retained. I do not modify the images in any way from how they were computed. I need to have the essence of the concept still be there. But I do understand that I am placing my own interpretation on them, so they are not 100% pure, but close. Also at a recent conference one question arose that some of them looked like Islamic patterns - I did not have any specific style in mind - I let the math go where it naturally goes. I only evaluate what I should keep and what I should change. That is a problem also, because I could be throwing out some interesting ideas.

TN: I am contemplating using a spirolateral design for a tattoo. Have you had other people approach you to use your work in different, perhaps unexpected ways?

Krawczyk: Jewelry was been mentioned. IIT just got a laser cutter, so I am going to try to produce some of the designs in brass or some other metal. I can see the 3D version as being furniture. I still have not produced any. Eleanor [Kent] also suggested embroidery. But I would like to return to architectural forms at some point. I am fighting the thought of actually having to build something by hand - I want to use a technology that can.

TN: You do not want to work with your hands? Is this more of a practical concern or would it in some way be cheating to, for example, carve a chair out of wood by hand?

Krawczyk: I was trying to make that point because much of the art world [has] such a great investment in the hand of artist in the final work. I do think craftsmanship and artistic ability should be celebrated and rewarded. But I also think there is craftsmanship of the mind as well as craftsmanship of the hand. Both should be celebrated.

Having heard more traditional artists and sculptors speak about their work and how they do it, especially ones that deal with mathematical concepts, how they also start to develop ideas for variation while in the middle of a piece, trying different material, trying a different tool to get a different texture, combining materials, colors changes, etc. [is] no different than the process I go through when writing a program. The variations stream from the current work. You want to quickly finish the current piece so you can go on to the next.

TN: Because of artists like yourself and other Ylem members, I am working at a time when technology and art are not seen as the mutually exclusive disciplines they used to be. In the past, only the architect was both the analytical realist and creative artist. But now you are seeing art disciplines like the degree I hold in 'Conceptual and Information Arts' or university departments like 'New Media,' 'Computer Arts,' and 'Art and Technology' to name a few. As a professor, what is your take on these disciplines? Would your work be any different if you had had the opportunity to study in one of these areas where Art and Science meet?

Krawczyk: Well, science and art do meet in architecture, so maybe my start was the best. I know the opportunities to pursue a variety of technologies would have been presented in an Art/Tech education. But I have thoroughly enjoyed working in the architectural profession and [to be able to] bring that experience to my artwork. I now have PhD students who are working in seashells, blobs, fractals,

tures and people I interact with are in fact armatures of triangle meshes tacked onto these Sony boxes. Someday the meshes disappear, and my office-mate at school is revealed to be a black box with levers sticking out of it. The triangles are scattered across our office floor. "Are you Jon Pearce?" I say to the box, and the lever in front goes up and down nodding yes. I keep walking around the Expo hall, more and more into it. I'm better able to see things now, with familiarity it's less of an overwhelming jangle. Something I notice is that there are some women dressed in black up on stages dancing, two different stages. Each woman has reflective beads attached to her cat suit. Around the stage are computer monitors showing realtime moving wireframe models of the girls. The almost all male developers are interested in this, both in the dancing women and in the moving wireframe models. We hardly know which to stare at the most.

I listen to the presentation at the Vicom Motion Capture stage. Around the stage are eighteen megapixel digital video cameras shooting 25 frames per second. The dancer is Megan. She has dark lips, a perky smile, a messy pinned-up ponytail that's in the wireframe models as well. She yawns, dances, poses while the pitchman talks. She's as ceaselessly active as the tendrils of a sea anemone. She leans, the epitome of grace, on the partition separating the stage from the pit where two programmers sit running programs to clothe her wireframe bod in rendered triangles. She has one arm akimbo. What a gulf between this live California girl and the programmers thinking about how best to "spend their triangles" on her rendering. She disappears offstage for a few minutes and when she comes back, she holds out her arms to be recalibrated because, the British-accented announcer brays, "Megan's just gone to the bathroom." She makes cute, outraged protests. The developers are keenly interested in this information about the presumed state of Megan's triangle

At the tail end of the conference, I catch a talk by Michael Abrash, who's working on the Microsoft Xbox, a ballyhooed new gaming platform on the horizon. It has Nvidia graphics hardware. Abrash has been testing it for a year. He's a super-programmer, the co-author of the classic first-person shooter game Quake. The hall is filled shoulder-to-shoulder with hardcore techie game developers, maybe a thousand of them, there's not a single woman in view, not so much one single triangle of femininity as far as I can see. Abrash lets loose like a fire hose. A complete geek info-spew. The Xbox is to deliver 125 million triangles per second! All this to draw Megan's arm akimbo. After his talk Abrash is besieged by questioners, they're like dogs fighting over a piece of meat, which is Abrash's brain. Being under a Microsoft Non-Disclosure Agreement --- and you can imagine what that must be like --- he can't give them as much as he'd like to.

As it turns out, I'm having dinner with Abrash, along with two of his Microsoft cohorts. They want to pick my brain about wild computer-science ideas for video games.

On the way to meet them at the restaurant I stop in at St. Joseph's cathedral. A humble party of working-class San Joseans is gathered there, one of the church officials is prepping them for a wedding they're going to have at noon tomorrow. The richness of this space, the murals, the dimensionality. . The grains of the wood and the marble. The humanity of the people in the wedding party. Will the geeks of a hundred years from now be volumetrically modeling wood and character animating better sims of people? Why, why, why?

At dinner, Abrash is brilliant and intense, a man looking for another big score. I make some suggestions about videogame things I'd like to see. Having just finished writing a novel about the fourth dimension, I'm particularly eager to see a four-dimensional videogame. The glass screen of your computer could as easily look onto a simulation of hyperspace as onto a simulation of regular space. Abrash is resisting this, though, he's more attracted by the siren song of Cellular Automata, which are a

Still from *Quake*

wondrously gnarly precursor of Artificial Life. I happen to have some opinions about this too; it's great to be talking to someone who might actually do something with them. An undulating surfscape made of continuous-valued Cellular Automata --- now that would be worth spending your triangles on!

All in all, the Game Developers Conference was a vastly energizing experience, like a brief immersion in a floating university. These guys totally get the old-time hot-rodding aspect of what computers are for. They're not for delivering groceries, for God's sake. They're for speeding like hell to places nobody's ever seen.

www.mathcs.sjsu.edu/faculty/rucker.cellab.htm

your keyboard in case you can't remember the fifty or a hundred possible key commands. A quarter-dome of white cloth with colored lights inside it; the lights supposedly flash in synch with the events of your game, like red for an explosion or yellow when you shoot your gun. I'm already overloading on the shooting all around. Your gun, your gun, your gun.

There's virtual tactile-feed-back to be had. A company has a joystick with a motor in its base so it can push back. The screen shows a ball on a trampoline. As you wiggle the stick you feel the trampoline sag, give, then pitch the ball up. And the stick slams back when the ball comes down.

The worst product of all is from digiSCENTS(TM) with the iSmell(TM) technology, a little humidifier-like thing that sits by your computer and pulses out a waft of scent in synch with your game. They have the most impressive booth-bunnies in the whole hall, women in skunk suits with big implanted boobs. But it's not enough to make any rational developer or gamer want to touch this product. So far as I can tell, the product hasn't actually been synched to any real game, I think they're still looking for more funding.

A guy gives me a demo where you're playing Doom. The shot-gun blasts smell like, he claims, daffodil, the extra bullets like wintergreen, the enemies like butterscotch, but really all

Sony's robot dog Aibo

you feel is the wind of the puffs of air. Surely this guy must know that his company is doomed.

I have a momentary wave of revulsion. Virtual Reality is alive and well here, but it's being used for such crappy purposes. It's like having a million dollar synthesizer and playing Whitney Houston songs. One guy is demoing a design program in which he's produced a beast called Bubba. Bubba has eighteen thousand triangles and has surfaces made up of these very cool mathematical functions called NURBs. But Bubba's a completely shitty and moronic looking monster, like Disney at his generic worst. NURBs and eighteen thousand triangles to be just as stupid as ever.

I calm down by watching a Microsoft demo of the software compiler they're calling VisualStudio.NET, also known as Visual Studio 7.0. To the palpable relief of the programmers around me, version 7.0 looks very much like the version 6.0 that we have all been using for the last two years. One never knows

when Microsoft is going to choose to fuck one over with their latest Brave New World of compatibility issues.

Above the Microsoft demo area is a giant poster, a banner really, of a guy with a nose ring and a Maltese Cross piercing in his tongue, his mouth open screaming, this is for their DirectX software library. How odd to think that this is how one of the world's largest companies sells tools to serious programmers! How far we've come from the suit-and-tie companymen of the 1950s.

I cruise the Expo Hall a lot more over the coming days and I begin to have more and more fun. I watch some developers playing the demo games set up. One is a Japanese game called Jet Grind Radio about skater painting graffiti. Amazingly antisocial. I talk to the guy playing with it. "I like how they make it look like cels," he says. "Each figure has a thick dark line around it like in a cartoon." Another game being played is Samba Amigo, with an interface that is, yes, a pair of maracas. "That's the most brain-dead game I've ever seen," I say to a developer. "Yeah, but it's awesome," he said. "I've been playing it a lot." The game is to shake the maracas in patterns indicated by circles that have dots appearing in them, you follow the dots. In the background is an endless procession of colorful shapes, like a three-day ecstasy trip or something, hot-dogs in serapes, grinning amigos, cute computer-graphics girls with huge spherical boobs.

I meet some Irish guys from a company called Havok who have a physics package for games, it basically solves spring equations and the like in real-time so that you can have bouncing hair, flapping cloth, and spinning rocks with accurate collisions. This used to be supercomputer Virtual Reality, and now it's a plug-in package for game developers. They're asking a pretty penny, though, $75K for the full game developer's kit. Oddly enough, Havok's biggest competitor is a company called Karma out of Oxford University. Back in the Old World, they really teach students something.

Sony is there with a pen full of Aibos, their robot dog. I reach in and snap my fingers, an Aibo comes over and sniffs me, I pet its head, it sits back on its haunches and whines, I'm in love. A Japanese programmer shows me something that looks like a videocassette with little levers in its sides. In his broken English he is giving me to understand that this cassette-sized box is the inner hardware of the Aibo, and that I could develop my own shell to put onto the box, Sony is looking to license to developers. I have a flash of a world in which all the crea-

and possibility in music, and one Master's student in the Mobius strip, and I am currently researching forms based on the interpretation of 3D cellular automata. Where else could I be involved in such a wide range of interesting ideas? Starting in an art education most likely would have taken me down another path.

Architecture is a wonderful education [that allows you] to do a number of things professionally - very few of my graduating class ended up being traditional architects. This education taught me how to examine a very complex problem, break it up into its core components, solve each with some technology and then assemble it into a complete living environment. It brings art and technology together on a large scale (most of the time successfully).

But not having a formal art education or math or computer science forces me now to work that much harder to learn the things I need. I try to salvage from these fields as much as I can. Maybe not having the formal education frees me to see things [in] a less constrained fashion. Experts in a single field are sometimes limited by their own knowledge. What makes Ylem very interesting is that these people are willing to cross fields...

TN: Could you tell me a little more about your involvement with Ylem and what you have gotten out of it?

Krawczyk: From the newsletter I get a better insight into others' work - many of which are very different from mine. I see other work it encourages me to follow my own path, and documenting current work is very important. Outside of conferences, there are not too many places where we can write and meet about our work. The part I do miss, not being in San Francisco, are the member meetings - maybe it is time to open regional chapters or hold a yearly meeting.

TN: Bathsheba Grossman's work might be considered free form 3D spirolaterals in metal. I saw her work and spoke with her at the Ylem 20th anniversary show. Her work is "modeled by hand and eye, not generated by mathematics,"[2] but it is informed by mathematics.
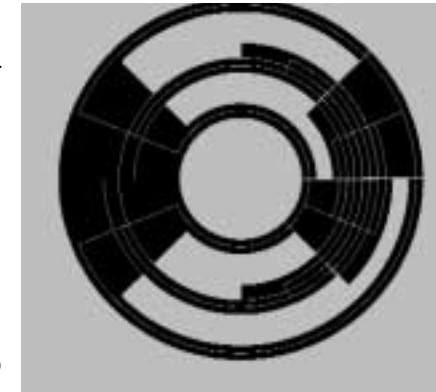
Krawczyk: And Carlo Sequin and Brent Collins' work also are similar in nature. Brent's [sic] sculptures are larger scale in wood or cast in bronze. Unbelievable beauty and craftsmanship. What Carlo and Bathsheba do on a small scale Brent does on a large scale by hand. There is a good description of Bathsheba's and the others work in the MOSAIC 2000 proceedings. [sic] I believe that the basis of their work is different - covering polyhedra, knots, and curved surfaces. What is amazing is that Brent is not educated in mathematics or computer science.

But what is the same or similar is having a mathematical framework to work within, to develop variations and a variety of interpretations from [that framework]. What is also interesting is that in many cases, such as the spirolaterals, the math is very simple - but the results exhibit a great complexity. Beauty can be exhibited in both the simple and the complex. All media has its own particular physical limitations - a consistent mathematical framework can also be thought of as the material from which these sculptures are made from. Staying within a framework focuses your exploration.

Footnotes

[1] the Sol LeWitt reference is "Do Wall Drawings," Art News: New York 3, #2 (June 1971), you can find it at page 376 of the retrospective catalog. Also "Sentences on Conceptual Art," Art-Language 1, #1 (May 1969), page 371 of the catalog, have many digital/concept relationships.

[2] Art statement at www.bathsheba.com/about

Artifical Fish

make a reflection line. He uses the word "pooch" a lot.

Will Wright, the head of Maxis, gives a talk called "Design Plunder." It's in the civic center, a huge crowd is there. Wright is the designer of SimCity and recently The Sims, which is kind of like a live doll-house with humanoid Sims you move around and do things to. The Sims do things on their own as well, you can sit back and watch a situation play itself out.

Will --- somehow you can't call this guy by his last name --- gives a great talk. First thought on seeing him come out: what a geek. Hawaiian shirt, a Charlie Chaplin mustache, skin so bad you can tell from thirty rows back, lank

Will Wright's Game, *The Sims*

dirty hair. There's a big screen behind him that shows his head and screens on either side showing slides of his Power Point slides. I should mention that everyone but everyone uses Power Point nowadays, slides that are inside their portable computer and which come out on the video projector.

Will talks about Christopher Alexander's book, A Pattern Language, a chunky old $60 tome from Oxford University Press. Everyone keeps hyping this book to me, I gotta check it out. It's one of the inspirations for the biggest new buzz in the software engineering community: Software Patterns. Will talks about the patterns of Hierarchy, Network, Landscape. He has a good line about makes a good user interface. "A user interface isn't done until there's nothing left to remove."

As a complete non-sequitur he throws in a slide of some woolly animal and says, "The Vicuna is a relative of the Llama." Inside joke: Wright's business card calls him "High Llama," as in Dali Lama.

He starts showing some of the "stories" people have made up with their Sims. Like kids having stories about their Barbies or G. I. Joes, except now they're in computer form. There are sites where you can get "skins" to make your Sims look however you like, e.g. you can dress them in bondage outfits or in spring break ski vacation outfits. Will shows a story where some kids are in a ski lodge and one of them dies and they hide the body inside a snowman. He dreams of having computer software to recognize a developing story and help along by, perhaps, putting in obstacles to the goal so that the story gets more complex.

It's all good, but after awhile I can't listen to any more talks. I go to see a demo reel of some of the best visuals from this year's games. A Chinese girl in a grotty tenement. It's high time for the Chinese to be cyberpunk like the Japanese. Forget about all the historical stuff, get with the Western program, yes! It'll come. Now the reel shows gothic devils by a lake of lava. A man in a top hat, ah, the wonderful sinister quality of a top hat. Creatures with three legs, I notice a number of these in different people's games. "I dare to dream of three legs!" Laser beams with hoops of emphasis around the beam. A cartoon world with a woman who gets out of a coffin, like Sleeping Beauty or Snow White, and she has the biggest, pointiest breasts I've ever seen, bigger even than Jessica Rabbit's. Man, I'd like to see her triangle! For the rest of the conference I'm looking for this game, but I can't find it. Then the reel shows a hooded man in the rain, it's a Japanese game with long credit sequence like a Noir movie. The game is called Metal Gear Solid, terrific Japanese-style name, the way they always get the words in slightly the wrong order. The reel shows a world called Exmachina with cool funky dirigibles and a screaming fat woman with blue pig-tails. "I dare to dream of blue pig-tails!"

There's also a reel of demos from a European movement called the "Demo Scene," with more info at www.scene.org/dog. These are small executables that produce images and sounds. They try for 64K exe size. Seem to be written in BASIC, my dear. Shocking. They're like loops you'd see in a European disco. The programmers have names like KKowboy, The Popsy Team, and Byter. The demos are weak, but it's always great to see high-tech stuff get out on the street.

Time to hit the Expo Hall. First thing I notice is that most booths are giving away toys. The developers call it "schwag." There's Slinkies, clackers, Hackey-sacks and, ah, Silly Putty. I get five green Silly Putties from Nvidia. I've always wanted enough Silly Putties to completely fill up the plastic egg it comes in. My egg is so full it bounces when I drop it. Tactile feed-back.

There's some pretty odd game add-on equipment in the lesser-frequented booths. Plastic sheets to lay over
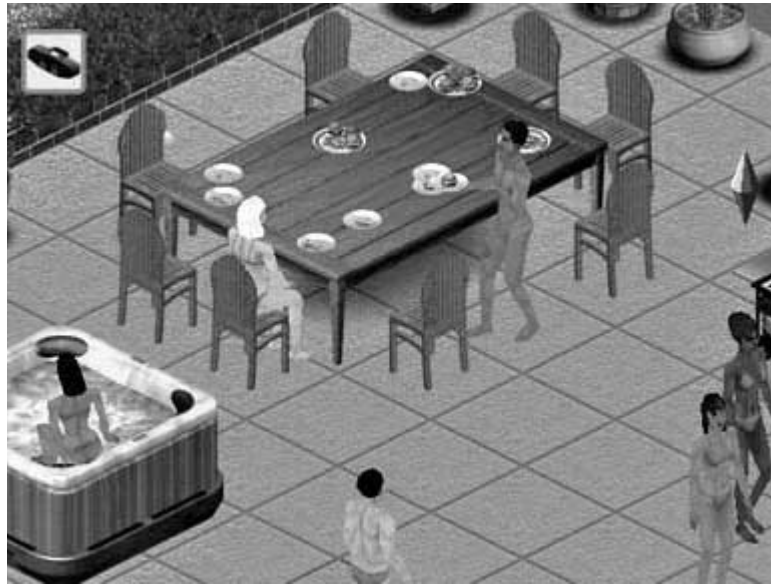
Will Wright's Game, *The Sims*

abrupt change when a ball, say, goes from using twenty triangles to using two hundred triangles. He's spewing out primo buzzwords here. "More highly tessellated." "Water-tight tessellation." It's very close to gibberish, with eighty percent of the words technical. "Polynomial patches, vertex shading, alpha blending, shadow buffers, bump mapping." "T&L" for "transform and lighting." At first I thought he meant T&A, those female kinds of curved surfaces. Submerged in male geekdom, I long for the presence of women. Women have the only triangle that really matters after all, the Delta of Venus, the pubic patch, the triangle of love and life. Women, Nature, Fresh Air! But that's not what we're talking about at the OpenGL demo.

The speaker shows a demo that zooms in on a blue glass banana slug shape, the lighting is continuous, and the image isn't "popping" because extra triangles are invisibly seeping out of seams in the slug when you make it bigger. "Isn't that great?" he says.

I'm boggled by the intricacy of the gyrations we are forever going through to make our simulations run fast. This will never end, I suddenly realize. The real world is inexhaustible. More computational ability just makes us do harder simulations. It's like the thing Nagel said. More guns, and the soldiers are more desperate than ever. Enough OpenGL for today.

I check out a tutorial on "Interactive

Storytelling." How do you tell a story in a game? A screenplay is totally different from a story, it's all about showing instead of telling. But a game, it's not even about showing. It's about letting people find stuff. And somehow you have to herd the gamer along a dramatic trajectory. How to do this is a mind-boggling question. But the speaker doesn't know the answer. The audience is the most interesting thing in this session, they're not at all the same crowd as in the Advanced OpenGL session. I begin to grasp that the game developer community is a veritable university, with designers, programmers, writers, artists, businessmen and marketers.

I find some of the artists at a "Conceptual Design" session I wander into. The speaker here is an artist, who illustrates his talk with detailed marker drawings that he does on a sheet of paper that sits beneath some TV cameras, a high tech overhead projection set up. Long periods of silence while he draws. How wonderfully realistic his hands look. He is explaining how to draw shiny things so they look cool. It's great. The audience is even less like programmers than the writers were. Inarticulate artists, one asks a question like "Why is something that sticks up kind of shiny? Why is it dark at one edge?" I learn a lot. There's an interesting reversal in this talk. Rather than focusing on how to draw a 2D picture that looks like a 3D object, the guy is really talking about how to deform the meshes of a 3D object so that the 2D image in the game rendering will look cool. He talks, for instance, about putting a pooched-out "bone" on a surface to

Rudy Rucker

Spending Your Triangles

Recently I'd been worrying that e-business — whether booming or busting — might eat up all available mind share for thinking about computers. Even though the e-bust has come, the media continues to slobber over the same trivial, dead-end, greed-headed stuff. Must e-tailing

and networking forever dispossess such wonderful aboriginal CS topics as Virtual Reality, Chaos, Fractals and Other Gnarl?

I've been less worried about this since last spring, when I went to the Game Developers' Conference in California. Everything great about computers is still alive and well in the world of videogames. Here, for your consideration, is my report.

Outside in the park are some homeless San Jose people. Our fair city. A chunky blonde street-girl is chewing

an enormous shiny nail, like a ten-penny nail, its head sticking out of her mouth. Two phrases cross my mind: "Tough as nails," and, "Biting her nails."

I'm an Artificial Life aficionado from way back. Called "Alife" for short, this field studies how to create computer simulations of things that behave like living creatures. In a thorough-going Alife simulation, the creatures will even breed and evolve. Alife was big in the 1980s, but it's kind of died out. Like Artificial Intelligence, Alife failed to deliver on its initial wild-eyed promises. Simulations don't in fact evolve into cool things very fast. If you regard Earth as a large, specialized computer, you'll observe that it's been running for billions of years, parallel processing itself at every point of space, pumping along at an update speed limited only by things like Planck's constant and the speed of light. Kind of hard to match that on your desktop machine. So I'm excited to see that the conference has a tutorial on Artificial Life in Games. (Info on the talks for this tutorial is at www.jfunge.com/gdc2001.) The game community still hasn't really picked up on Alife. The tendency is to have games that behave in predictable, replicable ways --- unlike living things. It would be great if Alife could rise out of academia and break into the lively, moneyed world of videogames. Finally an application!

A University of Toronto professor named Demetri Terzopoulos gives a talk on an Artificial Fishtank he made; it's a virtual world populated by simfish, or simulated fish. The program isn't really a game, or if it is a game, it's a zero-player game, meaning that it's just something you look at. Nor is Terzopoulos's program a product you can buy, it's only been presented in museums and big conference demos. He shows us a slide of a Japanese girl in big shutter glasses inside a portable Virtual Theater peering at his simfish. Ah, the eternally cyberpunk quality of the Japanese. But I digress.

Although the simfish aren't all that important in and of themselves, lets talk about them for a bit, by way of getting somewhat up to speed on the general principles of how one generates virtual realities for use in games.

Like many virtual critters, the simfish are based on skeletons something like a few wire squares and triangles hooked together. These skeletal shapes each have lump masses at their corners, and their edges are "viscoelastic elements," which are like springs coupled with dampers. As well as acting like bones, the edges act like muscles.

To make the critters look good, the flat faces of their skeletal squares and triangles are replaced by smooth mathematical surfaces, like car fenders, say. One of the most commonly used computer-graphical surface is in fact named a Bezier patch, after a Monsieur Bezier who

designed fenders for Renault in the Fifties.

How do you draw a smooth surface? Well, you tessellate it, which means you break it into lots of small triangles. Tessellation is a theme that comes up over and over in the conference. Basically it's all about triangles, all of the time. Why not squares? The graphics cards like triangles better. When a card draws a 3D object, it moves all the triangles into position in a virtual 3D space, calculates how they would project onto your computer screen, and then colors the triangles in, taking into account any lights or fog that you may have placed into your virtual scene.

So when you look at a simulation of a 3D object in a videogame, you're actually looking at a mesh of triangles that are artfully filled in with colors. The colors within any single triangle can vary from corner to corner and across the triangle's face, so that it can become virtually impossible to tell where the individual triangle borders are. The process of turning a model into a screen image is known as rendering, an odd word, really, given that "to render" also refers to the process of melting the fat out of animal carcasses skeletons by heating them.

A computer can only handle so many triangles per second, and if your simulation runs at slower than something like thirty updates a second, it sucks. A too-slow simulation looks jerky and clunky. So you need to keep the number of triangles down to the bare minimum needed to make something look nice. Thanks the ability to color the triangles in artful ways, you can get by with fewer triangles than you might imagine. An appropriately shaded icosahedron of twenty triangles, for instance, can look almost like a sphere. If you use something called Phong shading instead of Gouraud shading, you can even make a cube look like a sphere. But this is more than you want to know.

As well as the graphical appearance of the simfish, we also have to worry about their behavior, which comes down to sensing, thinking, and acting. This is where AI comes in. Whatever compute time a game doesn't spend on its triangles, it spends on its critters' Artificial

Intelligence. You share your energies between creating your world and thinking about it.

In order to think, of course, a critter needs to know what's going on around it. To speed things up, you can let them cheat and look up the other critters' positions in an "oracle" that is simply the program's data. Or they can do it the hard way, like humans do, and ray-trace lines into the world and see what the lines run into.

Each of Terzopoulos's simfish has an AI mind based on mental states called Hunger, Libido, and Fear. A simfish fears collisions, predators, and above all the walls of the tank. The fear of a wall is absolute, deeper than any emotion, the simfish can't overcome it. What if "fear" was all that really did keep you from walking through a wall, what if one's impression of the world's solidity was just a weird kind of innate behavior? Looking at these simulated worlds sets the mind off down odd pathways indeed.

Simfish

Figuring out the AI for your game creatures is a big deal. Given that the creatures have to update thirty times a second, the AI has to be fast, though you can in fact let a critter think a little slower than it moves. Like maybe he only looks around and thinks after every three graphics updates, and if he sometimes sticks part of a finger inside of a wall, who's looking that closely. Whatever it takes to stay over thirty frames per second.

Terzopoulos shows us fish mating, chasing each other, running away and so on. Rather than actually writing the code for their AI, he let the behaviors evolve over time by the genetic operators of reproduction, mutation, and selection, which is what Alife researchers like to do. "Fuck programming, we'll let the answer evolve!" Over human-scaled periods of time, this doesn't actually work very well on real-world problems. But its good enough for little toy worlds like the simulated aquarium. The fish move around pretty good. The scene that sticks in my mind the most is a demo of virtual fishing, where a hook hauls a simulated fish out of sight. Imagine the horror of this for the simfish!

During a break in the talks, I chat with a guy named John Nagel who happens to be sitting next to me. He's one of the founders of Autodesk, Inc., where I worked for a few years in the Nineties. Nagel is a genius and an eccentric, loaded with interesting, skewed ideas. He remarks that the main thing that makes money is the marketing, not the tech, that's why cool things aren't emerging as fast as they could. He comes up with a great bon mot regarding why we are working so hard these days: "Better technology helps workers about as much as better weapons help soldiers in a war." The new tech just makes it worse for the workers, it spews out more shit for them to deal with. The generals love the new weapons, but all they do for the soldiers is kill more of them. You know that nostalgic, wistful feeling you get when you look at a Forties movie and nobody is using a fucking computer? Must have been nice.

The next day I ambitiously start in on an all-day tutorial on how to take advantage of accelerated graphics cards for your 3D rendering. Some guys from the Nvidia graphics card company are explaining how to use the special 3D graphics protocols known as OpenGL, formerly the property of Silicon Graphics but now a lingua franca across all kinds of platforms including the great King Kong of Windows. The Nvidia guys are, it turns out, not talking about OpenGL in general so much as they are talking about some special new OpenGL functions that are only going to work on their new $600 graphics card called GeForce 3. They show us a cripplingly complex demo, an animated chameleon who changes from chrome to glass to colors while crawling along a branch. "After what we tell you today there's no reason you can't write a demo just like this," says the introducer. Rrright. I look over at the twenty-something graphics hacker next to me. We exchange grins like students in a class that's harder than we expected.

The first speaker talks about how to go about deleting more and more vertices of an object's mesh as it gets farther away --- so as to not be wasting compute time on unnecessary detail. He talks about "not spending too many triangles." He uses the acronym LOD, for Level of Detail. The problem that exercises this guy is how to dynamically change the LOD tessellation without what he calls "popping," which would be an unrealistic-looking